



EPA Region 7 TMDL Review

TMDL ID: IA 0-NSH-00675-L **Waterbody ID:** IA 05-NSH-00675-L
Waterbody Name: LITTLEFIELD LAKE
Tributary: LITTLEFIELD LAKE
Pollutant: ALGAE, TURBIDITY
State: IA **HUC:** 10240003
BASIN:
Submittal Date: 8/12/2006
Approved: Yes

Submittal Letter

State submittal letter indicates final TMDL(s) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act.

The TMDL for Littlefield Lake was formally submitted by the Iowa Department of Natural Resources (IDNR) in a letter received by EPA on August 21, 2006.

Water Quality Standards Attainment

The water body's loading capacity for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards.

The loading capacity is set through the use of a lake response model to target the annual amount of total phosphorus (TP) that Littlefield Lake can receive to meet its designated uses. To address the identified pollutants (algae and turbidity), the Carlson's Trophic State Indices (TSI) were used to link the concentration of TP to the quantity of algae and turbidity as measured by Secchi depth (SD). By setting a TSI for TP of less than 70, the chlorophyll (algae) and SD (turbidity) indices are expected to be reduced to below 65; thereby meeting the desired Iowa's narrative water quality standards (WQS). These corresponding concentration values for TP and chlorophyll are 96 ug/L and 33 ug/L, respectively and the SD target is equivalent to 0.7 meters (m). To achieve the TP TMDL target, a 61% reduction in loading is established. Because lake conditions represent responses to environmental load occurring over an extended period of time, expression of the load as an average annual value is the preferred approach found in current scientific limnological literature. Expressing the TMDL in daily time steps would mislead the reader by implying a daily response to change in daily loading. Although a short-term response after a precipitation event could have localized lake effects, Iowa assesses the mean conditions of their lakes over the growing season, for example, an average of 3 samples per summer over multiple years. The growing season mean is affected by factors such as the following: internal lake nutrient loading, water residence time, wind action, and the interaction between light penetration, nutrients, turbidity, sediment load, and algal response.

Numeric Target(s)

Submittal describes applicable water quality standards, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.

Designated uses of Littlefield Lake are Primary Contact Recreation (A1) and Aquatic Life Support (B (LW)). In 1998, Class A1 and B uses were assessed as partially supported because of problems with high sediment delivery rates and poor water clarity. In 2004, the impairment was changed from siltation to turbidity and algae were listed as impairments. The lake was assessed in the 2000, 2002, and 2004 305(b) reports as partially supporting due to poor water clarity and heavy blooms of bluegreen algae thereby impairing primary contact recreation. The state deems these conditions as not complying with their narrative WQS. Nutrient ratios suggest that algal production at this lake is potentially limited by nitrogen availability. The State of Iowa does not have numeric criterion for nutrients or turbidity in their WQS. The lake, however, exceeded the narrative WQS which states that "water shall be free" from aesthetically objectionable conditions. Carlson's TSI were used to link the concentration of TP to the quantity of algae and turbidity as measured by SD.

Numeric Target(s) and Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety that do not exceed the load capacity.

Carlson's TSI scores were used to define an established linkage between TP, chlorophyll, and water transparency as based on reference lakes. Phosphorus is the principal nutrient target because of blue-green algae's ability to fix atmospheric nitrogen and the overabundance of phosphorus inputs. The Vollenweider 1982 Combined OECD model was used to relate TP loading to growing season in-lake concentrations. Because phosphorus is closely related to suspended solid, reduction in either contaminant is expected to have a commensurate reduction in the other.

The existing TP load to Littlefield Lake is estimated to be 2,157 pounds per year (lbs/y), which includes 2,136 lbs/y from external nonpoint sources and internal loading, and 21 lbs/y from atmospheric deposition. Turbidity is caused by algal conditions and a non-algal sediment load of 1,070 tons per year (T/y) delivered to the lake. The current sediment delivery was determined using RUSLE and 2005 land uses. To address the sediment issue, the TMDL established a loading capacity of 171 T/y. Also by reducing the TSI for total phosphorus from the current level of 74 to 70 the TSI score for chlorophyll should respond by a commensurate decrease based on the relationship seen in this lake; therefore, the target Chla TSI score of less than 65 should result. The TP loading capacity is set at 925 lbs/y. The TMDL does not establish daily loads because lake response is a result of the loading for an extended time period prior to any given measurement. There is little, if any benefit, in modeling the lake neither on a daily basis nor to establish targets on a daily basis. While localized turbidity and, to some degree, algae may be tracked as responding to short-term rainfall, whether the targets were set on a yearly basis or on a daily basis would not change the implementation practices necessary for this non-point source only TMDL.

Source Analysis

Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, non point and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

Only nonpoint sources influence the TP and sediment loading. There are no point source discharges in the watershed. A significant source of phosphorus loading is internal recycling. All sources of TP have been considered.

Allocation

Submittal identifies wasteload allocations for point, and load allocations for nonpoint sources. If no point sources are present the wasteload allocation is zero. If no nonpoint sources are present, the load allocation is zero.

A TP allocation is set at of 925 lbs/y and a sediment capacity of 171 T/y.

WLA Comment

The WLA is set to zero.

LA Comment

The Load Allocation (LA) of TP for this TMDL is 835 lbs/y distributed as follows:

814 lbs/y allocated to the nonpoint sources in the Littlefield Lake watershed and internal recycling of phosphorus from the lake bottom sediments.

21 lbs/y allocated to atmospheric deposition.

Nonpoint sources in the Littlefield Lake watershed include agricultural production land, pasture, precipitation, and groundwater. To meet the desired in-lake water quality of 96 ug/L of TP, a 61% reduction from current loads would be required. This results in an annual TP loading of 835 lbs/y. This reduction in total phosphorous loading will also reduce chlorophyll-a concentrations.

The LA to nonpoint sources for turbidity is 154 tons of sediment delivered or resuspended in the lake. Nonpoint sources in the Littlefield Lake watershed include; agricultural production land, pasture, precipitation, and groundwater. To meet the desired water clarity in the lake of 0.7m, an 86% reduction from current sediment loads is required. This results in an annual sediment loading of 154 T/y.

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided.

The MOS is set explicitly to 10% for both sediment and TP.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

This TMDL was developed based on chlorophyll, transparency, and sediment contributing to generalized lake conditions. The annual targets should result in WQS attainment regardless of the season.

Public Participation

Submittal describes public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s).

The TMDL was available on Iowa's web site for at least 30 days prior to the close of the public comment period on August 7. The IDNR TMDL staff met with the Audubon County Conservation Board on July 5, 2005 and with the Audubon Soil and Water Conservation District office on May 11, 2005 to discuss the TMDL process and gather information regarding the lake and its watershed. Public comments received were given consideration and, where appropriate incorporated into the final TMDL.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies the monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used).

Further monitoring is needed at Littlefield Lake to follow-up on the implementation of the TMDL. This monitoring will, at a minimum, meet the minimum data requirements established by Iowa's 305(b) guidelines for a complete water quality assessment (3 lake samples per year over 3 years, 10 lake samples over 2 years, etc). Lake monitoring is currently ongoing at Littlefield Lake, with a minimum of three samples collected per growing season.

Reasonable assurance

Reasonable assurance only applies when reductions in nonpoint source loading is required to meet the prescribed waste load allocations.

There are no point sources in the watershed and reasonable assurances are therefore not required.